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An Empirical Analysis

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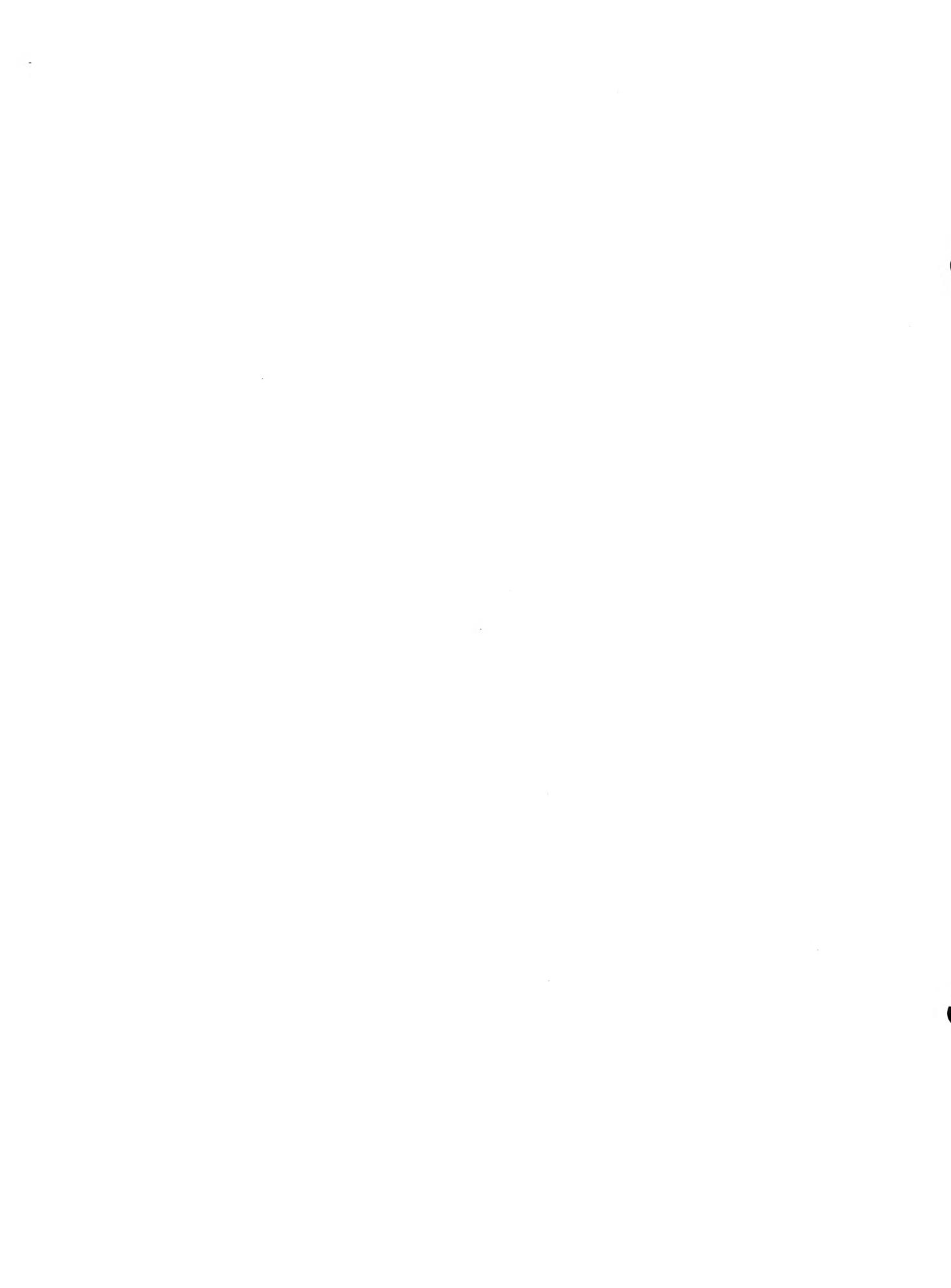
Risk, Return and Rate Base Valuation Methods:
An Empirical Analysis

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Abstract

It has been observed that utility executives generally argue for inflation adjusted rate bases while consumer groups advocate original cost valuation methods. Recent analytic and empirical studies indicate that rate base valuation methods should not and do not account for differences in utilities' realized rates of return. However, there is evidence that <u>changes</u> in valuation methods may cause changes in realized returns due to over or under compensation for the effects of inflation.

This study examines the impact of changes in rate base valuation methods on (1) expected shareholder returns, (2) realized shareholder returns, and (3) systematic risk. A unique time series data set and a new statistical procedure are used. Overall, the results are consistent with earlier studies. However, the results for utilities in one state provide support for the argument that investors fare better under fair value regulation.
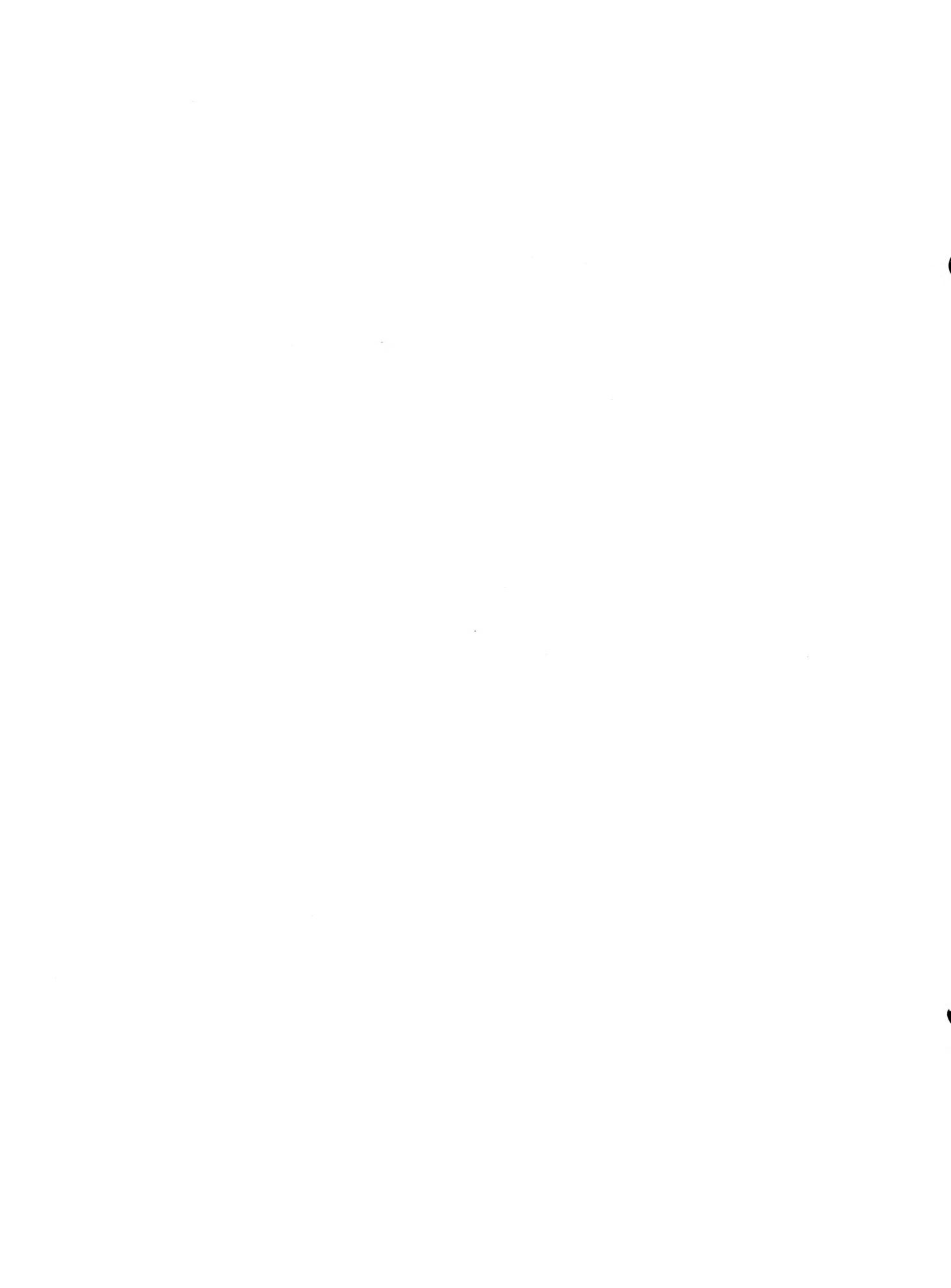
RISK, RETURN AND RATE BASE VALUATION METHODS:
AN EMPIRICAL ANALYSIS

Investors, consumers and managers of utilities are concerned with the methods of rate base valuation used in utility regulation. Generally, utility executives and investors prefer the use of inflation adjusted rate base methods while consumer groups support the use of original cost valuation procedures. However, recent analytical and empirical studies suggest valuation methods should not and do not account for differences in utilities realized rates of return [4, 5, 10, 13, 14, 17]. In particular, Greenwald [5] concludes that any rate base valuation method is admissible as long as the allowed rate of return is appropriate for that particular rate base valuation method. Also, Gordon [4], assuming perfect regulation, argues that investors should be indifferent between original cost and inflation adjusted rate bases while consumers should prefer inflation adjusted methods. Primeaux [13] and Rock [17] performed cross sectional empirical studies of accounting rates of return under different rate base valuation methods and concluded there was no systematic relationship between rate base valuation methods and accounting rates of return.

However, there is evidence that changes in rate base valuation methods may cause changes in accounting rates of return realized by the utility subsequent to the valuation method changes due to over or under compensation for the effects of inflation [14]. While no strong systematic relationship was found, it was observed that regulatory commissions have difficulty determining the appropriate allowed rate of return when rate base methods are changed, and realized rates of return may be different after the valuation method change.

This study examines the impact of changes in rate base valuation methods on (1) expected shareholder returns, (2) actual shareholder returns, and (3) systematic risk.

As previously observed, Gordon [4] and Greenwald [5] suggest that if the allowed rate of return is appropriate for a particular rate base valuation method, investors in utilities should be indifferent as to the valuation method utilized. This argument will be supported if no systematic relationship is found between rate base valuation methods and expected or realized returns or systematic risk. However, if returns are systematically greater after a change from original cost to fair value methods or are systematically less after a change from fair value to original cost methods, then the arguments of utility executives and consumer groups are supported.

Overall, this study provides empirical support for the Gordon and Greenwald assertations that there is no systematic relationship between rate base valuation methods and expected returns or realized returns. However, a state-by-state examination of the results reveals one state's regulatory performance strongly supports utilities' preference for the fair value rate base valuation method. As expected no systematic relationship was found between rate base valuation methods and systematic risk.

A new data set and a unique statistical procedure are used to evaluate the effects of different rate base methods on the financial performance of regulated firms. Previously published studies have only used cross sectional data to assess the effect of rate base methods. But at any one time, imposed regulation is firm-specific, not industry-specific.

Thus it seems that the relevant focus of attention of evaluative research should be on the firm, through time, and not on a cross section of firms at a point in time. For this reason the data of this study consists of time series information for individual firms located in all states where rate base valuation methods have been changed sometime since World War II. This procedure, together with the specially-devised econometric method, makes it possible to examine the same individual firms operating under the constraints of both fair value and original cost rate base valuation methods. Section I outlines the problems associated with rate base valuation methods and briefly reviews previous studies. The method of analysis is presented in Section II and the empirical results are discussed in Section III. Section IV presents the conclusions and implications.

I. Public Utility Regulation

Rate Base Valuation Studies

The rate base has received considerable attention in previous studies. Myers [11] has observed that, historically, accounting earnings and book values were used in setting the rate of return and rate base. He suggested the use of market determined rates of return and book value rate bases in determining revenue requirements. Regulatory lag could be used to provide an incentive for the utility to operate efficiently. Robichek [16] observes that a major problem in regulation is how to apply a market determined rate of return to the book value of an utility's equity. He advocates the use of the capital asset pricing model for determining the allowed rate of return to equity holders. Gordon [4]

compares historical cost rate base regulation with inflation adjusted rate base regulation and concludes that, under perfect regulation, investors should be indifferent between the two methods and consumers should prefer the inflation adjusted method. He notes that his conclusions are contrary to the positions generally taken by utility executives who advocate inflation adjusted rate bases and consumer groups who advocate original cost methods, and suggests the differences may be partly due to regulatory lag. Greenwald [5] shows that for a broad class of rate base valuation methods (including original cost, replacement cost, and fair value) any rate base method is admissible if the allowed "fair" rate of return is appropriate for the particular valuation method. Most recently, Marshall, Yawitz, and Greenberg [10] suggest that the traditional method of applying an allowed rate of return to a rate base is inappropriate. They derive an explicit fair rate of return which is a function of "the firm's product market, the technology of its production process, the price of a unit of capital, and the risk-return preference of investors in the capital market." The study ignores problems associated with rate base measurement and regulatory lag.

There have also been several empirical studies which examine the association between rate base valuation methods and realized rates of return. Eiteman [3], using fifteen Bell Telephone companies, found that the commissions using the original cost rate base valuation method permitted the highest allowed rates of return while the commissions using the reproduction cost rate base valuation method permitted the lowest allowed rates of return. Hagerman and Ratchford [7] using 79 utilities from 33 states reported that original cost jurisdictions allowed a sig-

nificantly higher rate of return than the replacement cost jurisdictions. Pike [12] reported that the mean rate of return under the original cost method was less than the mean rate of return under other valuation methods. However, the differences were not statistically significant. Primeaux [13], using standardized rate of return data, found no significant differences in realized rates of return between original cost jurisdictions, fair value jurisdictions, and replacement cost jurisdictions.

While these studies suggest that regulatory commissions do adjust the rate base and allowed rates of return, evidence has also been presented which indicates that when rate base valuation methods are changed, the allowed rate of return adjustment sometimes over-compensates and sometimes under-compensates utilities. That is, the change in the allowed rate of return is not appropriate relative to the change in the size of the rate base due to the change in valuation methods. Primeaux, Bubnys, and Rasche [14] used time series data in analyzing the impact of changes in rate base valuation methods. They reported that there was no systematic relationship between rate base methods and realized rates of return.

These prior studies have generally focused on accounting data in calculating realized rates of return for the utilities. This study utilizes both market and accounting data in analyzing the effect a change in rate base valuation method has on expected shareholder returns, realized shareholder returns, and systematic risk.

Rate Bases and Allowed Rates of Return - The Theory

The objective of public utility regulation is the setting of service prices which balance the interests of consumers and investors.

Historically, electric utilities were regarded as "natural monopolies."
That is, it was argued that because of operating characteristics and
the large amount of capital investment necessary to secure economies of
scale, the market in a particular area could support only one capital
intensive firm. Utility regulation is intended to proxy the benefits
of competition in the pricing of service and to attempt to avoid prob-
lems of monopoly whenever only one firm is permitted to serve a given
market.

In the regulation of utilities, regulatory commissions determine
the total amount of revenue necessary to cover (1) operating expenses,
(2) interest and preferred dividend payments, (3) taxes, and (4) a "just
and reasonable" return to equity holders. The dollar amount required to
provide a just and reasonable return to equity holders is determined by
multiplying the allowed rate of return by the rate base.

Two of the most controversial issues in public utility regulation
revolve around (1) the appropriate rate base, and (2) the "just and
reasonable" rate of return to equity holders. A major question concerning
the appropriate rate base is the cost basis on which the rate base should
be measured. Should public utility property be valued on the basis of
original cost, fair value, or reproduction cost? Questions concerning
the appropriate rate of return to equity holders involve the estimation of
investors' required rates of return and the relationship between this market
determined rate of return and the rate of return to be allowed on the
utility's rate base. This study is concerned with rate base valuation.

Investors in utility stocks prefer higher allowed rates of return
and higher rate bases while consumers prefer the lower service prices

associated with lower allowed rates of return and lower rate bases. However, if regulatory commissions allow higher (lower) rates of return when using lower (higher) rate base valuation methods, revenue requirements may be similar and the rate base valuation method may be irrelevant.

Fair value rate base valuation methods are preferred by investors and utility executives because they feel that if original cost valuation is used inadequate adjustments are made for inflation. Consequently, a key for using fair value instead of original cost valuation is to attempt to compensate the regulated utility for the effects of inflation. If an analysis is made in real terms, however, there should be no expected performance difference if the regulatory commission compensates exactly for the effects of inflation.

Investor expectations concerning the effect of a change from one method of rate base valuation to another are quite important. Stock prices will reflect investors expectations of the firm after the method of rate base valuation changes. The returns expected by investors would be greater (smaller) after the change in rate base method if the investors believe that because of the changes the commission will over (under) compensate in the allowed rate of return. Over compensation, of course, would permit the firm to earn higher returns than were permitted before the change.

Whether the regulatory commission actually overcompensates or undercompensates for the change in rate base method will be reflected in the return actually realized by the firm; a higher realized return reflects overcompensation to the firm after the change in rate base methods.

There is no a priori reason to expect beta to be affected by rate base methods. Changes in rate base methods should not affect the relationship between the specific utility's returns and the market returns. There would be no differential effect because the analysis is in real terms. So, if the adjustments made in fair value computations just offset the effect of inflation, no differential effect would be observed.

As mentioned earlier, the primary focus of this study is upon expected shareholder returns, realized shareholder returns and systematic risk. The interest centers on the question of whether or not they are actually affected in the same way as theory would predict whenever rate base valuation methods are changed.

II. Method of Analysis

The Data

A time series approach was deemed to be superior to a cross-sectional analysis for examining the issues of importance to this study. This procedure would permit an analysis of the impact of valuation method changes on the individual firms of a specific state. Each of the commissions from the fifty states and the District of Columbia were asked whether their state switched from one form of regulation to another during the 1948-1979 period. Since government publications of state-commission regulatory methods contain certain ambiguities, it was felt that a reliance on primary source information from the states themselves would clarify any uncertainties.

It was found that three states had unambiguously changed regulatory methods during the 1948-79 period. Illinois changed from fair value to

original cost in 1973, North Carolina changed from original cost to fair value in 1964 and Missouri changed from original cost to fair value in 1958. The value of the data is enhanced since not all changes were in the same direction.

All data expressed in real dollar terms were deflated by the GNP implicit price deflator. The electric utility operating data were obtained from Statistics of Privately-Owned Electric Utilities in the United States. Monthly returns and year-end closing stock prices were obtained from the CRSP and COMPUSTAT tapes, respectively, and from the Wall Street Journal. The Standard & Poor's Index of 500 large companies came from Standard & Poor's Statistical Service, while the interest rates used were annualized averages of three-month U.S. Government Treasury Bills from the Federal Reserve Bulletin.

All privately-owned electric utilities having a sufficient number of observations and data under both types of regulatory methods in their state were included in the sample. Of these firms, twelve had adequate stock price information and other data to be included in the analysis.

The Models

Security analysis often involves a general economic analysis, an industry analysis, and specific company analysis [2,15]. The models described below incorporates general economic, industry, and firm variables. Three dependent variables are analyzed; (1) expected returns, (2) realized returns, and (3) systematic risk.

Expected returns are estimated using the disconnected cash flow model:

$$k_e = \frac{D_1}{P_0} + g \tag{1}$$

where g is estimated as the average geometric growth rate in dividends for the previous five years, D_1 is the expected dividend and is estimated as $D_0(1+g)$, and P_0 is the price of a share of stock at the beginning of the year. If investors expected the regulatory commission to over (under) compensate in the allowed rate of return when the valuation method changed, the expected return would be greater (smaller) after the change. It should be noted that the growth rate in equation 1 should be the expected dividend growth rate. The growth rate used here is based on past growth due to (1) the lack of expected growth data for the 1948-1979 period and (2) the fact that historical growth rates often form the basis for expected growth rates in the electric utility industry.

Realized shareholder returns are calculated as:

$$R = \frac{P_1 - P_0 + D}{P_0} \tag{2}$$

where P_0 and P_1 are the prices at the beginning and the end of the year and D is the dividend received during the year. If regulators consistently over (under) compensated in the allowed rate of return after the rate base valuation method change, the realized return will be greater (less) after the change.

There are three components which may change the systematic risk measure, beta, where beta is defined as:

$$\beta_i = r_{im} \, \sigma_i / \sigma_m. \tag{3}$$

A change in σ_m, the standard deviation of returns of the market index, affects all securities while changes in r_{im}, the correlation between the returns of security i and the market index, and/or σ_i, the standard deviation of returns for security i, affects the beta of the ith security. Of course, offsetting changes in r_{im} and σ_i may result in no change in the beta. Changes in systematic risk due to a rate base valuation method changes would indicate that the regulatory commission is (1) changing the relationship between the specific utility's returns and the market's returns and/or (2) changing the uncertainty of total utility returns. There is no a priori reason to expect beta to change.

A separate set of three equations was run for each firm in the sample, with the exception of Missouri Utilities; this company's monthly return data were unobtainable for the risk variable (beta) analysis. Ordinary least squares regression was used throughout.

The models presented below emphasize the "flow" rather than "level" effect on the dependent variables. That is, the explanatory variables are defined for the most part as percentage changes from one year to the next, rather than annual levels. The following equation tests for the effect upon expected shareholder returns.

$$y_{t1} = B_1 + B_2 (\%\Delta E)_{t-1} + B_3 (\%\Delta C)_{t-1} + B_4 (IT)_{t-1} + B_5 (\%\Delta ROR)_{t-1}$$

$$+ B_6 (\%\Delta S\&P)_{t-1} + B_7 (\%\Delta ROR)^2_{t-1} + B_8 (INT)_{t-1} + B_9 (\tfrac{GNI}{ENI})_{t-1} \qquad (4)$$

$$+ B_{10} (ACTRET)_{t-1} + B_{11} (BETA)_t + B_{12} (T)_t$$

y_{t1} = Expected Return to Shareholders in year t as defined above,

$\%\Delta E_{t-1}$ = Percent change in production expenses in the previous year,

$\%\Delta C_{t-1}$ = Percent change in the utility's ultimate consumers,

IT_{t-1} = Industry Trend in year t-1, a measure of overall profitability in the privately-owned electric utility industry defined as $\dfrac{\text{Net Income}}{\text{Total Operating Revenue}}$,

$\%\Delta ROR_{t-1}$ = Percent change in a firm's accounting rate of return, defined as $\dfrac{\text{Net Income}}{\text{Net Plant}}$,

$\%\Delta S\&P_{t-1}$ = Percent change in the Standard & Poor's 500 index,

$(\%\Delta ROR)^2_{t-1}$ = the square of the percent change in rate of return,

INT_{t-1} = Interest rate at the end of year t-1, as measured by the annualized rate of U.S. government three-month treasury bills,

$(\dfrac{GNI}{ENI})_{t-1}$ = A diversification measure, defined as the ratio of net income of the gas to the electric portions of the company; this is omitted for purely electric companies,

$ACTRET_{t-1}$ = the actual return to shareholders in the previous year,

$BETA_{t-1}$ = the measure of systematic risk derived by use of the capital-asset pricing model with mostly five years (60 months) of data for each of the betas, and

T_t = a linear time index,

The two other models used the following equation:

$$y_{tN} = B_1 + B_2(\%\Delta E)_t + B_3(\%\Delta C)_t + B_4(IT)_t + B_5(\%\Delta ROR)_t + B_6(\%\Delta S\&P)_t$$

$$+ B_7(\%\Delta ROR)_t^2 + B_8(INT)_t + B_9(\frac{GNI}{ENI})_t + B_{10}(T)_t, \qquad (5)$$

where

y_{t2} = Actual shareholder return in year t as indicated previously, and

y_{t3} = Systematic risk in year t, as measured by beta.

The Econometric Procedure

The sequential econometric procedure was the following. First, each firm's data was divided into two subsamples, one longer than the other, corresponding to the two valuation methods used in that state. For example, the rate base valuation method for Illinois was fair value from 1948 to 1972, then original cost from 1973 to 1979. Before any observations were lost due to lagging some variables, the long subsample would include 25 observations of data (1948-72) and the short subsample would contain the remaining seven (1973-79). The subsample periods would differ for different states. An equation was run for each dependent variable on each firm over the long subsample. The coefficients, re-siduals and standard errors of the regression were used in subsequent steps in the analysis.

Second, the long subsample regression was extrapolated (forward or backward, depending on the time period of the long subsample) through the short subsample time period. The mean error was computed for the short subsample. Third, the standard error of forecast was computed for each short subsample observation, based in part on each variable's

observations and the coefficient variance-covariance matrix of the long

subsample regression. Fourth, under the assumption that the standard

errors of forecasts are independent across time, the standard error of

the mean forecast error was computed over the short period. This in-

volved adding the standard error of the long period's regression to the

standard error of forecast of each short period observation. Finally,

the ratio of the mean error for the short subsample to the standard

error of the mean forecast error was used to compute a t statistic for

the mean forecast error of the short period. Each of the above five

steps was followed for each dependent variable for each firm in the

sample.

III. Regression Results

It is important to remember, when interpreting the regression re-

sults in this section and the paper in general, that the data are in

real terms. As mentioned earlier fair value valuation methods are ad-

vocated as a means of better compensating utility firms for the affects

of inflation. Consequently, if the performance of a utility firm is

expected to change as regulatory regimes change, it follows that investors

expect that the regulatory commission will either over or under compensate

for the effects of inflation as the rate base method is changed. This

follows because if the commission just compensates for inflation the

firm's performance, in real terms, will remain unchanged.

a. Expected Return:

Table 1 summarizes the statistical results for the expected return

dependent variable. The t value in column three is found by dividing

TABLE 1

Results of Change in Rate Base Valuation Methods
on Expected Return

Firm Name	Mean Error	Std. Dev.	t Value	n_L	Adj. R^2	D.W.
ILLINOIS:						
(Fair Value, 1949-72						
Original Cost, 1973-79)						
Central Ill. Light	-.4372	.1095	-3.99[a]	23	.87	2.32
Central Ill. Public Service*	-.0933	.0655	-1.42[c]	20	.86	1.80+
Commonwealth Edison	-.6787	.1062	-6.39[a]	22	.81	2.39+
Illinois Power*	-.1206	.0418	-2.88[a]	22	.97	2.12+
MISSOURI:						
(Original Cost, 1949-57						
Fair Value, 1958-79)						
Empire District Electric	.0209	.0152	1.38[c]	22	.16	1.95+
Kansas City Power & Light	-.0910	.0411	-2.21[b]	22	.83	1.96+
Missouri Public Service*	.2350	.1167	2.01[b]	22	.15	2.67+
Missouri Utilities**	.0890	.0180	4.93[a]	22	.32	1.74
St. Joseph Light & Power*	.0146	.0244	0.60	22	.42	2.04+
Union Electric*	-.5602	.4239	-1.32[c]	22	.52	1.81
NORTH CAROLINA:						
(Original Cost, 1949-63						
Fair Value, 1964-79)						
Carolina Power & Light	-.1472	.0780	-1.89[b]	16	.95	2.20+
Duke Power	.1450	.0143	10.16[a]	16	.98	1.88

*Combination Company (includes gas)
**Missouri Utilities had insufficient data to estimate the beta variable.
  The regression was run with all other variables.

[a] Significant at 1% level
[b] Significant at 5% level
[c] Significant at 10% level

+ Cochrane-Orcutt Iteration used to correct for autocorrelation.

The mean error (column one) by the standard error of the forecast (column two). In addition, the size of the long subsample, the value of the adjusted R^2, and the Durbin-Watson statistic are listed.

In Illinois all four listed companies have significantly negative t values. This indicates stockholders expected the return to be lower after the change from a fair value to an original cost rate base valuation method in the early seventies. These results support the arguments of utility executives in that shareholders expected the Illinois regulatory commission to grant lower real returns after the change in rate base methods.

Backward extrapolation was needed for the Missouri regressions because the short subsample occurred before the rate base method change. Five of the results are statistically significant for this group of firms. Of these, the three firms with positive t values show higher expected returns before the change from original cost to fair value; the two firms with negative t values show that stockholders in the firms had lower expectations during the earlier original cost valuation period.

North Carolina, with backward extrapolation, also shows mixed results. One firm's stockholders expected lower returns under original cost valuation and the other firm's stockholders expected higher returns before the change to fair value.

The theories of Greenwald and Gordon are supported by the lack of a systematic relationship between rate base valuation methods and expected returns for the utilities of Missouri and North Carolina. However, the existance of significant differences in expected return after the rate

base method change testifies to the difficulty regulatory commissions have in determing an allowed rate of return.

It should be noted that the results reported are conservative when using the expected return (and beta) as the dependent variable. The growth term in the expected return variable is a 5-year geometric mean growth rate and, hence, the first four expected return observations following the change in valuation methods include some growth rates which occurred prior to the change. This smoothes the expected growth rate around the year of the change and reduces the likelihood of observing statistically significant changes in expected returns.

b. Realized Return:

Table 2 summarizes the statistical results for the realized return dependent variable. Just as before, the firms in Illinois are consistent in having negative t values, although only two are statistically significant. These results seem to indicate downward pressure on realized returns when Illinois firms were regulated by original cost regulation. For two firms' stockholders earned statistically significant lower actual returns after the change from fair value to original cost.

The results in Missouri are once again mixed. Only three t values are significant; two show lower actual returns under original cost valuation and one showed a higher return in this earlier period; three others, however, showed no statistical difference between valuation methods.

Both North Carolina companies experienced higher returns during the original cost period--conversely, lower returns after the change to fair value.

TABLE 2

Results on Change in Rate Base Valuation Method on
on Shareholders' Realized Returns

Firm Name	Mean Error	Std. Dev.	t Value	n_L	Adj. R^2	D.W.
ILLINOIS:						
(Fair Value, 1949-72						
Original Cost, 1973-79)						
Central Ill. Light*	-.0707	.1136	-0.62	23	.55	2.08[+]
Central Ill. Public Service*	-.4072	.1318	-3.09[a]	23	.80	2.13[+]
Commonwealth Edison	-.0546	.0916	-0.60	24	.23	1.85
Illinois Power*	-.2186	.09503	-2.30[b]	23	.77	2.19[+]
MISSOURI:						
(Original Cost, 1949-57						
Fair Value, 1958-79)						
Empire District Electric	-.1890	.0736	-2.57[a]	22	.74	1.92[+]
Kansas City Power & Light	-.0105	.0776	-0.13	22	.77	1.82[+]
Missouri Public Service*	1.2853	.3565	3.61[a]	22	.71	2.31[+]
Missouri Utilities*	.0023	.1120	0.02	22	.42	1.96[+]
St. Joseph Light & Power*	.0839	.0764	1.10	22	.83	1.99[+]
Union Electric*	-.9933	.1810	-5.49[a]	22	.88	2.34[+]
NORTH CAROLINA:						
(Original Cost, 1949-63						
Fair Value, 1964-79)						
Carolina Power & Light	.5222	.1384	3.77[a]	16	.77	1.86
Duke Power	.7067	.0684	10.33[a]	16	.89	2.18[+]

*Combination Company (includes natural gas)

[a]Significant at 1% level
[b]Significant at 5% level
[c]Significant at 10% level

[+]Cochrane-Orcutt Iteration used to correct for autocorrelation.

In summary four firms had statistically significant lower and three had statistically significant higher actual returns under original cost valuation. Five companies showed no change between the two methods.

c.   Systematic Risk Measure, Beta:

Eleven firms were tested for the effect of the change in rate base valuation methods on systematic risk. The betas were calculated using the capital-asset pricing model and 60 months of data. The betas were updated annually. Because of the overlapping monthly returns the results of the t-tests will understate the actual changes. The results are summarized in table three.

By contrast with the earlier results the firms in Illinois show no consistency among themselves. Risk declined for one company, increased for another, and showed no signficant change for two others after original cost valuation was inaugurated.

The same sort of inconsistency is seen in Missouri. Via backward extrapolation it is seen that original cost valuation resulted in lower risk in one firm, significantly higher risk in another, and no statistical change in three utilities.

The two North Carolina firms also showed mixed results. Extrapolating backwards, Carolina Power and Light had higher risk during the period of original cost valuation, and Duke Power had lower risk.

In summary the regressions run with beta showed the least number of significant changes in the t value resulting from a rate base valuation change. Three firms had lower risk under original cost and three others showed higher risk. What's more, each state had a firm in each category,

TABLE 3

Results of Change in Rate Base Valuation Method
on Systematic Risk

Firm Name	Mean Error	Std. Dev.	t Value	n_L	Adj. R^2	D.W.
ILLINOIS:						
(Fair Value, 1949-72						
Original Cost, 1973-79)						
Central Ill. Light*	-.4683	.3169	-1.48[c]	23	.05	1.33[+]
Central Ill. Public Service*	1.3821	.1852	7.46[a]	20	.72	2.06[+]
Commonwealth Edison	-.0483	.0550	-0.88	23	.25	1.97[+]
Illinois Power*	-.0503	.0507	-0.99	23	.63	1.83[+]
MISSOURI:						
(Original Cost, 1949-57						
Fair Value, 1958-79)						
Empire District Electric	-.1047	.0548	-1.91[b]	22	.05	1.56[+]
Kansas City Power & Light	.0210	.1035	0.20	22	.21	1.11[+]
Missouri Public Service*	.5365	.2338	2.29[b]	22	.27	1.71[+]
St. Joseph Light & Power*	-.0100	.0834	-0.12	22	.48	1.91[+]
Union Electric*	1.7650	1.4411	1.22	22	.38	0.93[+]
NORTH CAROLINA:						
(Original Cost, 1949-63						
Fair Value, 1964-79)						
Carolina Power & Light	.1773	.1263	1.40[c]	16	.32	1.74[+]
Duke Power	-.4502	.0511	-8.81[a]	16	.21	2.18[+]

*Combination Company (includes gas)

[a]Significant at 1% level
[b]Significant at 5% level
[c]Significant at 10% level

[+]Cochrane-Orcutt Iteration used to correct for autocorrelation.

Note: Missouri Utilities is not included here because of lack of data
to compute beta.

thus showing that the risk measure is firm-specific. Five companies
showed no statistical difference in risk between the valuation methods.
These results are also conservative due to overlapping returns in the
calculation of beta.

d.   Summarizing Across Dependent Variables:

Finance theory specifies that risk and expected return are positively
related. That is, higher risk requires a higher expected return. Inter-
variable comparisons are made for the sample of firms across the three
tables given above.

In Illinois, three companies (Central Illinois Light, Commonwealth
Edison, and Illinois Power) have negative t-values on both variables,
but at least one of these is not statistically significant. That is, after
the rate base valuation method change both the expected return and the
systematic risk were less for these three companies. Central Illinois
Public Service has a significant negative t-value for expected return and
a significant positive t-value for systematic risk. After original cost
valuation was instituted the risk measure increased while the expected
return declined for this company.

The Illinois firms show much consistency between actual and expected
returns as the valuation method was changed. All four utilities have
negative t values across both variables, and two of them have both
statistics significant. As the valuation changed from fair value to
original cost both expected and actual returns declined.

In Missouri one firm (Missouri Public Service) is consistent in the
"risk-return" tradeoff. Returns and risk are higher under original cost

valuation than under the fair value method. Empire District Electric is the only other utility with both t-values significant. For this company expected return was higher during the original cost period but the sysymatic risk measure, beta, was lower. None of the other Missouri utilities had statistically significant t-values associated with systematic risk while three other utilities had significant t-values associated with expected return (two negative and one positive).

Two firms (Missouri Public Service and Union Electric) were consistent with regards to actual and expected returns. The former firm had lower actual and expected returns after the change to fair value rate base method occured. The latter utility had higher actual and expected returns after the change to fair value. One firm (Empire District Electric) experienced higher expected returns and lower actual returns during the original cost period, before the commission's change to fair value.

In North Carolina the "risk-return" tradeoff is not evident. Carolina Power and Light stockholders expected lower returns after the change and systematic risk increased. Conversely, Duke Power investors expected higher returns; systematic risk decreased. But Duke's stockholders' expectations were consistent with actual returns--both significantly higher during the original cost period. Carolina P&L's investors expected higher returns after the shift to a fair value method, while they actually realized lower returns than what had been earned under original cost.

IV. Conclusions and Implications

Gordon [4] observed that utility managers argue for a type of fair value rate base valuation method for regulatory purposes. This valuation procedure allows for a higher (nominal) rate base than does the original cost method. Greenwald [5] concluded any rate base method is appropriate if the allowed rate of return is appropriate for that valuation method. Revenue requirements due to equity holders will be unchanged only if offsetting changes are made in the allowed rate of return. This study looks at changes in shareholders expected returns, realized returns, and systematic risk arising from changes in valuation methods. Since the analysis is in real terms, any differences observed between the two valuation methods really constitute over or under compensation for inflation.

The results of the study are quite mixed. Investors in Illinois utilities expected the regulatory commission to under compensate the utilities when the rate base was changed from a fair value to an original cost basis. These expectations were realized because shareholder returns were actually lower under the original cost regime; the lower earnings were statisticlaly significant. Systematic risk was also generally lower for Illinois utilities under the original cost valuation method. There was no consistent pattern in the utilities of Missouri and North Carolina. The relationship between valuation methods and expected and realized returns and systematic risk appear to be very company specific for these two states.

The results of the Illinois utilities provide support for the argument made by utility managers that shareholders fare better under fair

value regulation than under original cost regulation. The Illinois results
are probably due to either a consistent under adjustment of the allowed
return because of regulatory inability to determine an appropriate rate
of return for a different rate base or to a conscious effort by the
regulatory commission to lower real rates of return for Illinois utilities;
the first possibility seems to be more likely. For the utilities of
Missouri and North Carolina the evidence suggests that regulators in
these states are as likely to over compensate as to under compensate when
valuation methods are changed; there is no consistency demonstrated in the
data.

Overall, the results are mixed; Illinois provides support for the
arguments of utility executives while the results from Missouri and
North Carolina are consistent with the conclusions of Gordon who noted
that regulatory lag and political forces can cause allowed rates to
deviate from market required rates of return. Also, the lack of an over-
all strong systematic relationship between rate base valuation methods and
rates of return shows support for Greenwald's argument that any rate base
valuation method may be used if the allowed rate of return is appropriate
for the particular rate base method. That is, in general utilities are
neither systematically over or under compensated when the rate base
valuation method is changed. Together, the data seem to add to those who
have previously discussed the high degree of randomness which is inherent
in the regulatory process [13, 14].

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